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# CMMI: The DoD Perspective

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## **DoD's Software Challenge**

***"DoD estimates that it spends about 40%  
of its RDT&E budget on software - \$21B for FY2003" – GAO***



**F/A-22**



**SBIRS-High**

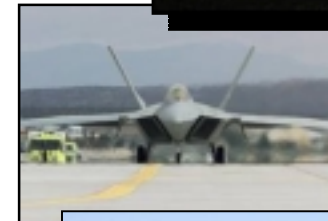
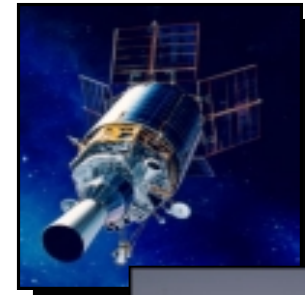
**"[Software] continues to grow in importance in our weapons systems - and remains a significant contributor to program cost, schedule and performance shortfalls." -- Pete Aldridge**



## Today's Development Challenges

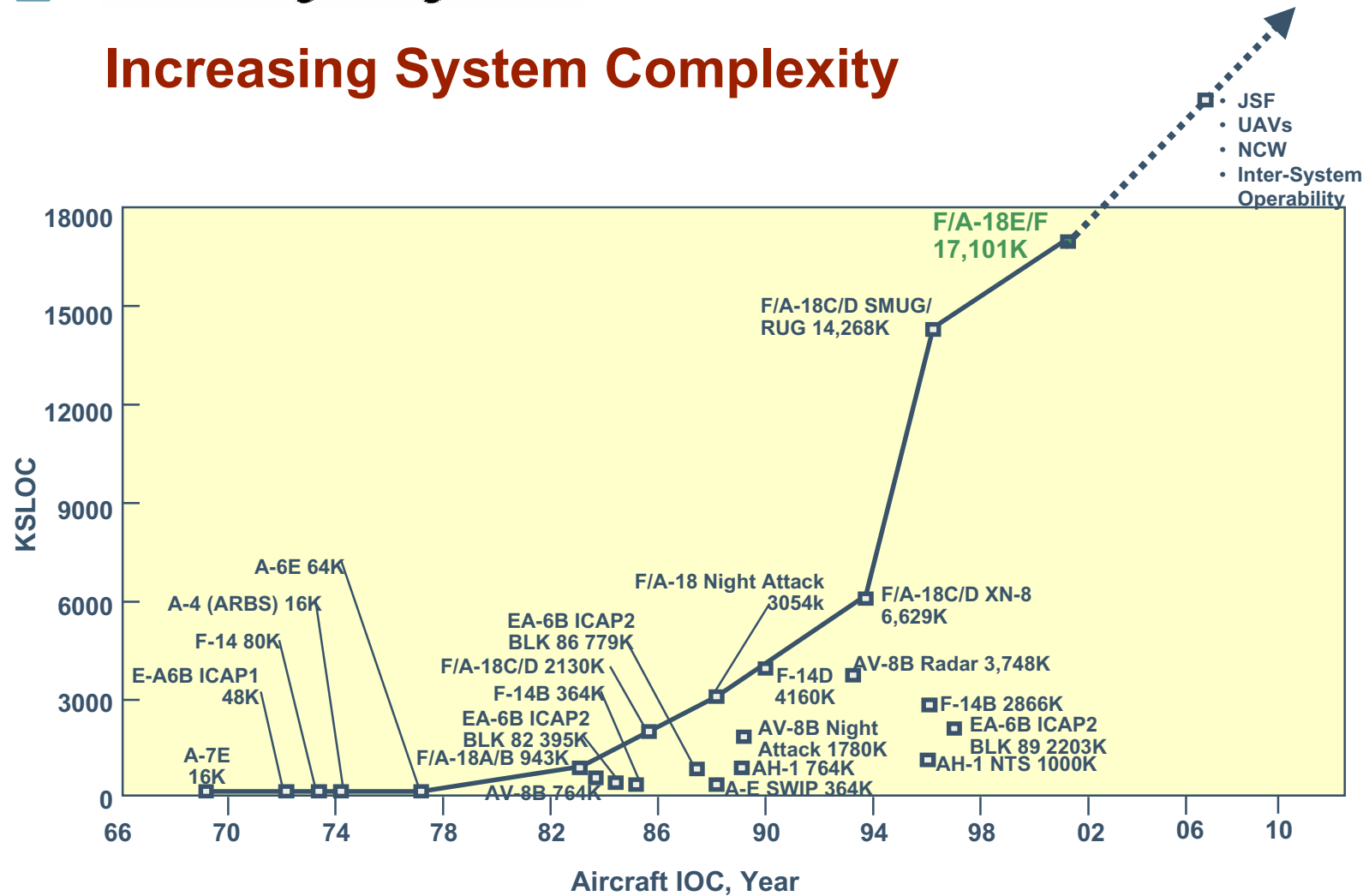
Huge system/software engineering endeavors in aircraft, space vehicles, command and control, ground infrastructure, battle management, etc

- Several million SLOC programs
- “Hybrid” systems combining legacy re-use, COTS, new development
- Multi-contractor teams using different processes; Dispersed engineering & development locations
- New technologies/products – rapid change and evolution; are they mature; obsolescence
- Business/operational needs change - often faster than full system capability can be implemented
- Skillset Shortfalls; Cost and schedule constraints
- Demands for increased integration, interoperability, system of system capabilities



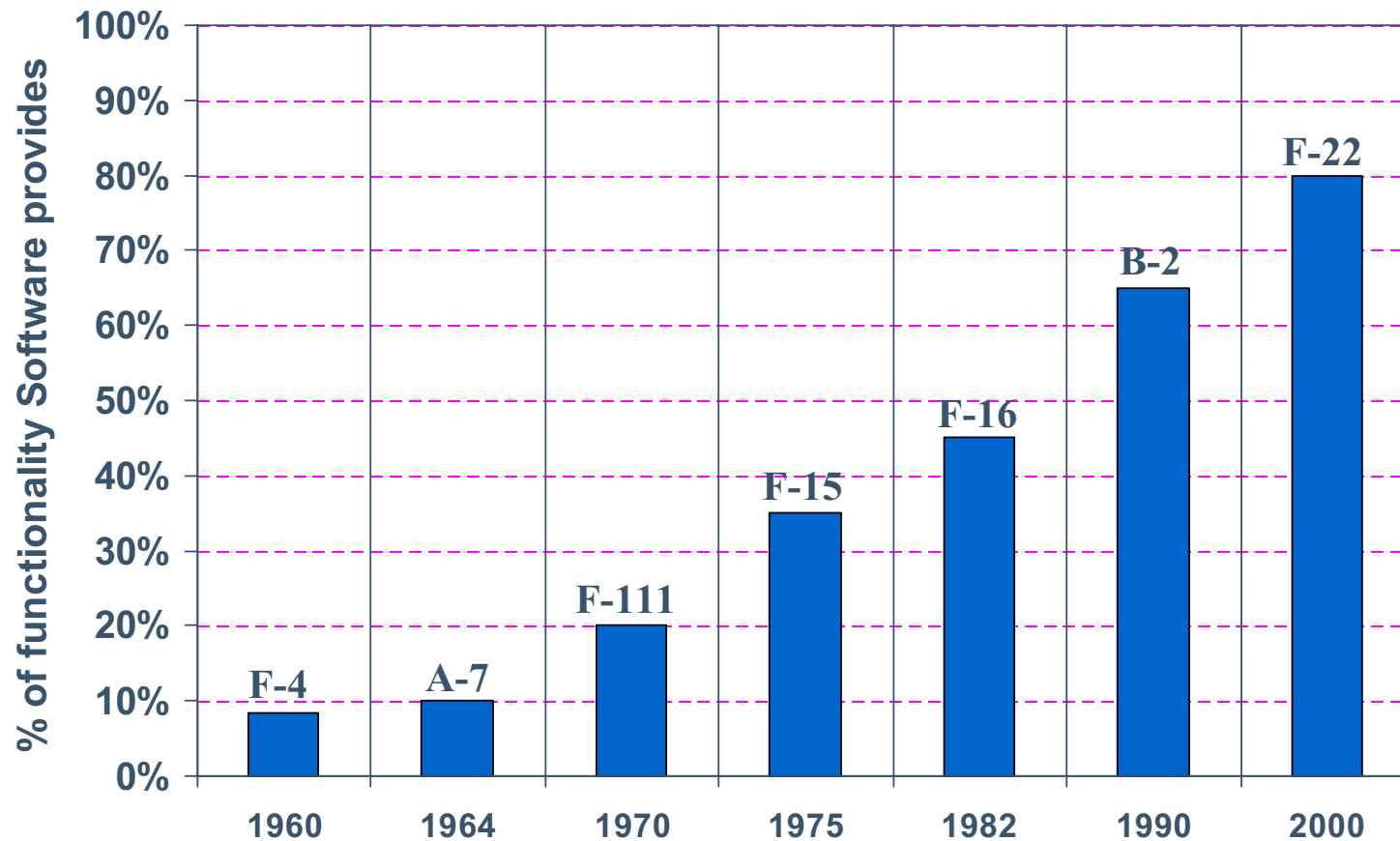


## Increasing System Complexity





## Capability Delivered in Software





## Software is Even in Bullets!

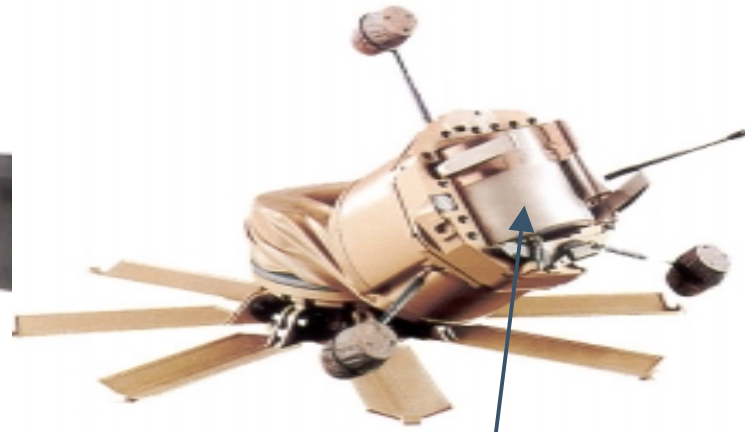
*150K SLOC - Weapon*  
*2K SLOC - Ammunition*  
*Ada*



©ICW Proof of Principle Testing 1999

**Infantry Combat Weapon**

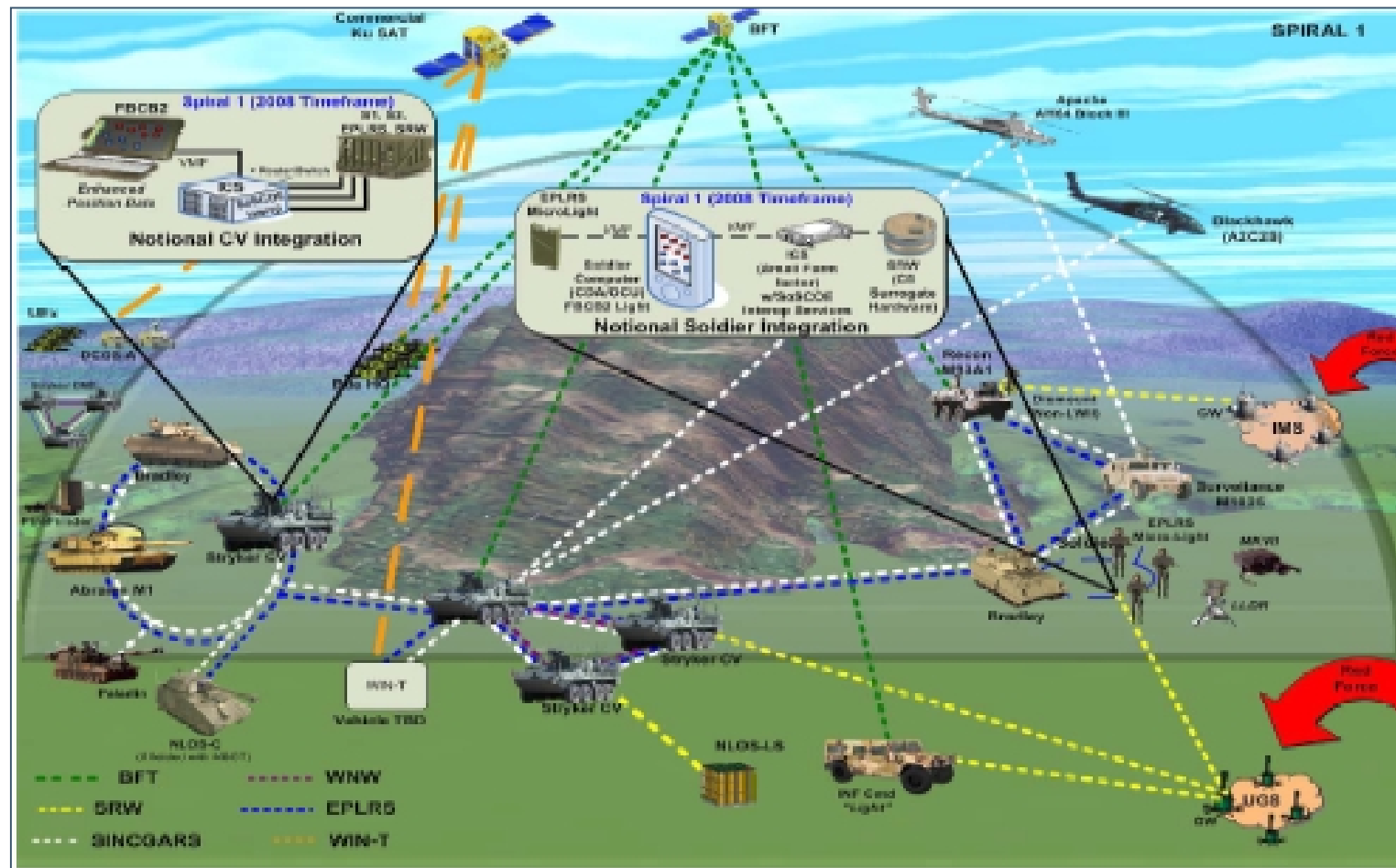
**Wide Area Munition**



*130K SLOC*  
*Ada, C++, C, Assembly*



## And Software Connects Systems...





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## Environment





## **Introduction: Current Environment**

Providing enhanced capability to the warfighter is a complex and conflict-ridden endeavor.

**Operational forces** demand war-winning systems. They need evolutionary enhancements to existing systems to maintain a cutting edge on the battlefield.

**Acquirers** need to maintain cost, schedule, and technical baselines to uphold their duty as stewards of the taxpayers' money and to satisfy oversight requirements.

**Contractors** need to win contracts to stay in business and sustain the industry base.

Underpinning these conflicts is an ever-increasing demand on systems and software engineering to solve the complexities of an interconnected battlespace.

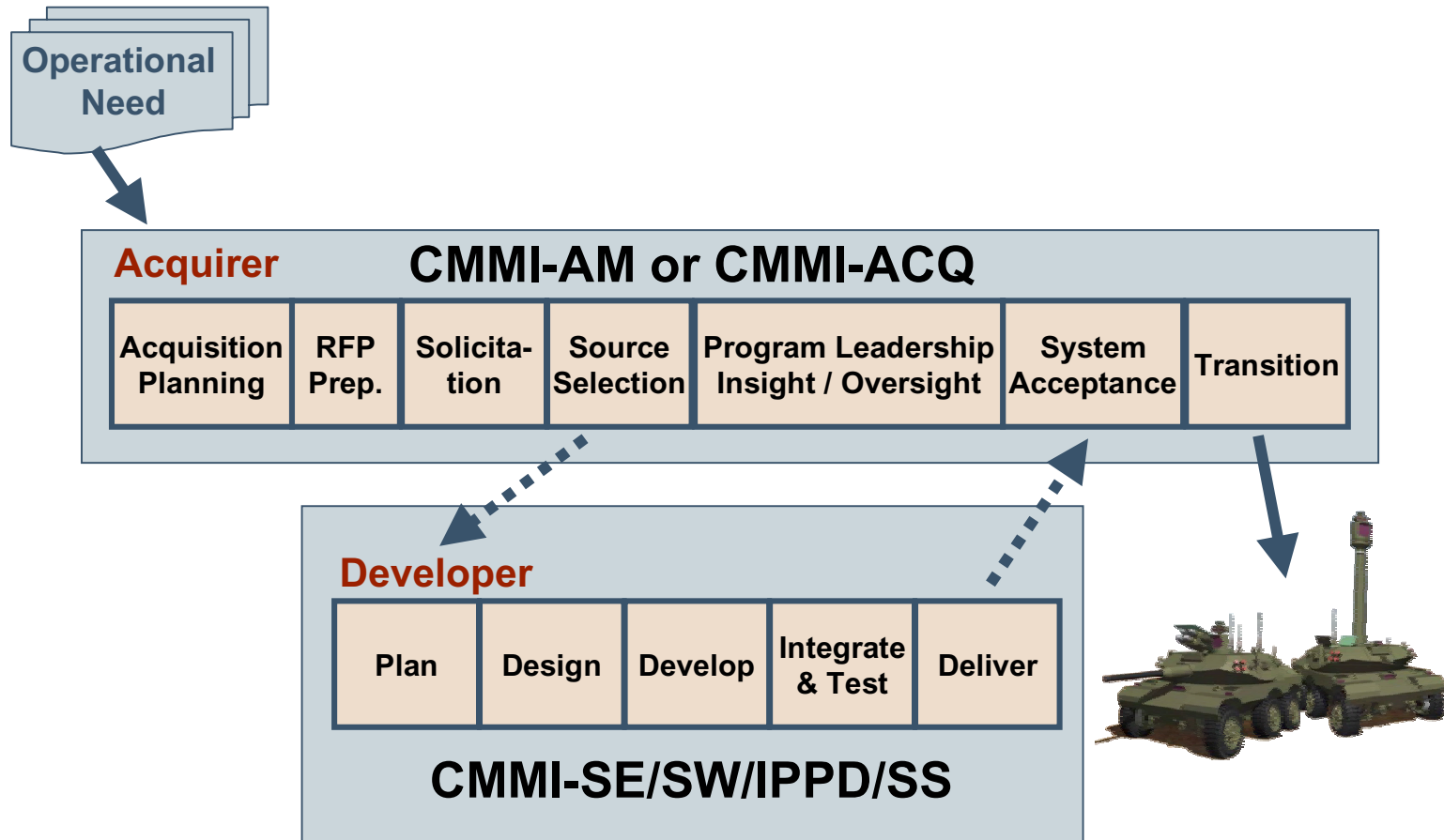
## The Acquirer's Job



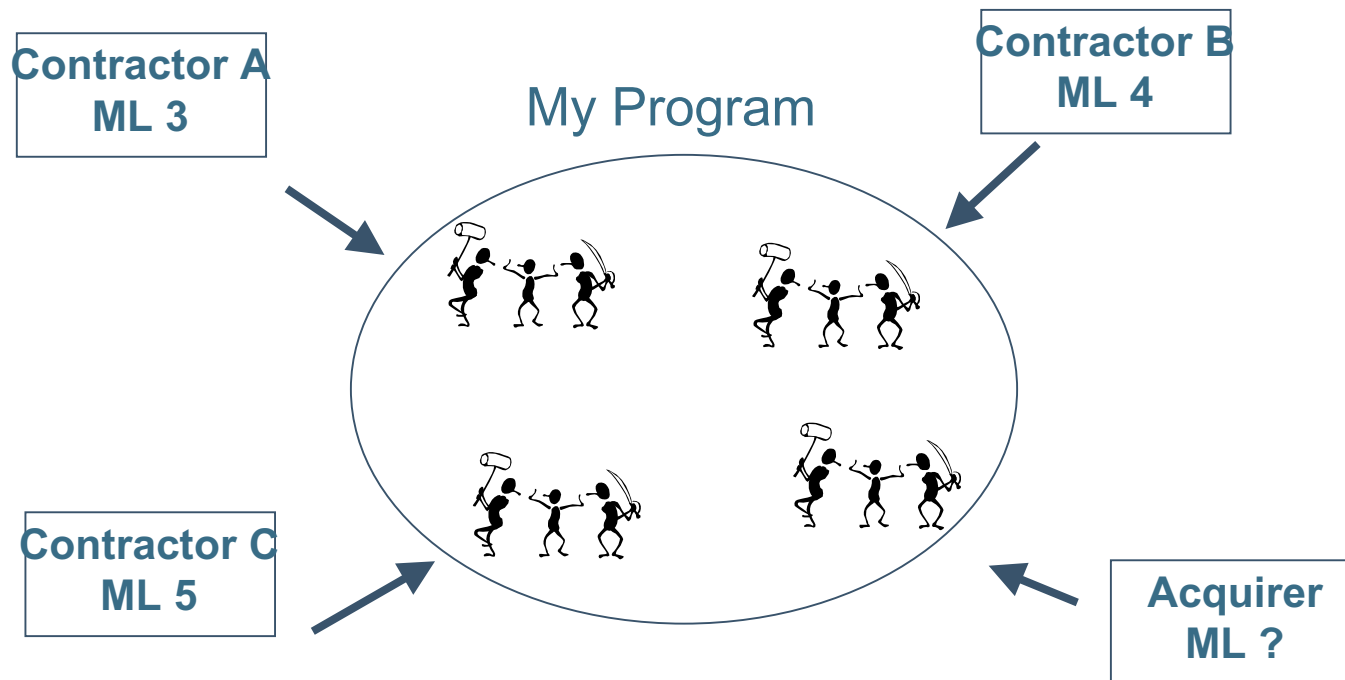
### Need to counter these attitudes:

- "I'd rather have it wrong than have it late." — Industry senior manager
- "Ad hoc, catch as you can...that's our motto." — PMO
- "We do not work problems until they're unrecoverable." — PMO
- "I don't want an ATAM [to reveal problems] on my watch." — PMO

## Visibility into the *Team's* Capability



## The “Team”



CMMI Math:  $3 + 4 + 5 + ? = ?$



## **DoD's Problem Statement**

Many DoD contractors advertise high levels of process capability or organizational maturity as measured by either the Continuous or Staged representations of Capability Maturity Model Integration, yet from the perspective of acquisition program managers on some high visibility *individual programs*, strong systems engineering and project management practices still appear to be lacking.



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## **Example**

**Large DoD program with multiple, geographically dispersed engineering locations.**

**Multi-contractor teams (10+) using different processes.**

**Several million lines of code.**

**Systems engineering challenges.**

**Combination of legacy, re-use, COTS integration and new development.**

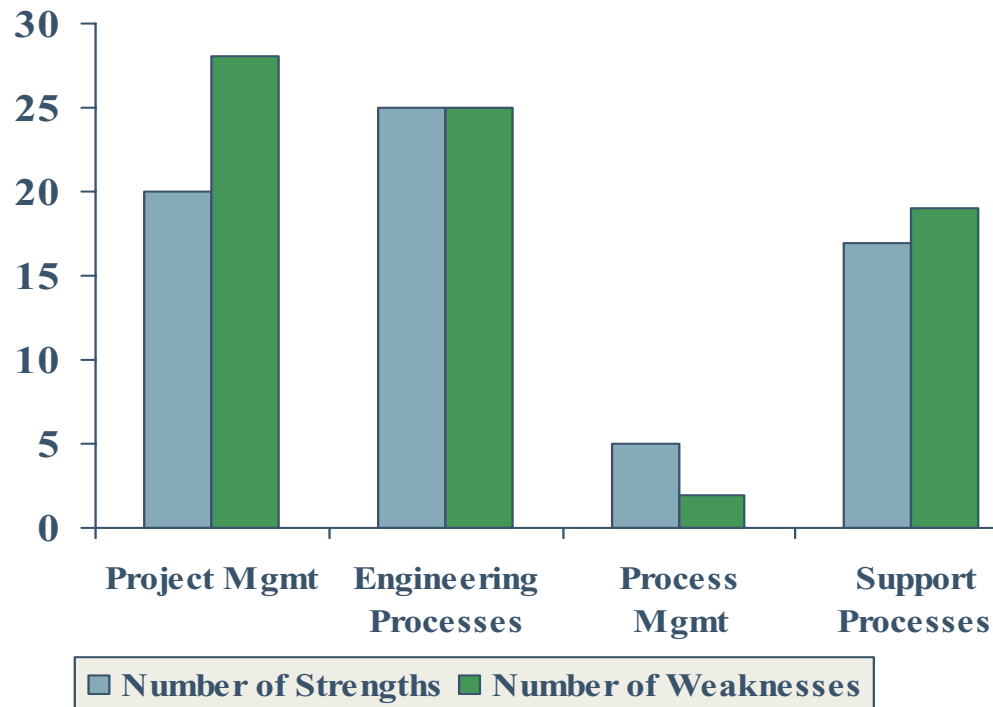
**All contractor sites are Maturity Level 3 or higher.**

**18 months after contract award, the program office conducted a CMMI “Class B” appraisal on the team.**





## Characterizing Results



### Project Mgmt Processes:

- Project Planning
- Project Monitoring & Control
- Integrated Project Mgmt
- Risk Management

### Engineering Processes

- Requirements Mgmt
- Requirements Definition
- Technical Solution
- Product Integration
- Verification (Peer Reviews)

### Support Processes

- Measurement & Analysis
- Product and Process Quality Assurance
- Configuration Mgmt
- Decision Analysis

### Process Mgmt

- Organizational Process Focus
- Organizational Process Definition



## **Issues Identified - Program Management**

**Lack of project plans or having only incomplete, conflicting or out of date project plans**

**Ineffective use of Integrated Master Schedule as basis for planning/tracking status across program**

**Undefined engineering and management processes on program**

**Inability to track and manage actions to closure**

**Inadequate cost estimation processes, methods, data and tools**

**Inadequate staffing and training project personnel**

**Tracking dependencies between or across teams not defined**

**Managing project data ad hoc**

**Inability to proactively identify and manage risks**



## **Issues Identified - Engineering**

**Lack of understanding of the program's requirements**

**Inability to trace requirements to architecture/design or to test plans/procedures**

**Poor linkage of functional and performance requirements**

**Inconsistent requirements management at different levels**

**No criteria for making architectural/design decisions among alternatives**

**Not capturing entire technical data package (requirements, design and design rationale, test results, etc)**

**Efficiency of design process/methods in question**

**Late definition of integration and test procedures**

## **Issues Identified – Support Processes**

**Difficult to identify items in configuration management baselines**

**Lack of ability to manage individual “versions” in incremental development**

**Inability to effectively managing changes to work products throughout lifecycle**

**Not conducting audits to establish/ensure integrity of baselines throughout incremental engineering and development**

**Inefficient change management process (cycle time, volume of changes)**

**Quality Assurance audits of products and processes not consistent**

**QA involvement in system and software engineering processes not consistent**

**No metrics to manage engineering activities (outside of cost/schedule data)**



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## **CMMI v1.2 – Part of the Solution!**

Increasing the integrity and credibility of the model

Emphasizing project “start-up” and process deployment

Increasing the integrity and credibility of the appraisal process

“Raising the bar” for SCAMPI Lead Appraisers

**CMMI is a key enabler as the DoD  
acquires increasingly complex  
capabilities and systems**



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